Aug. 27, 1957 A. F. RAPISARDA 2,804,528

RHEOSTAT

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Fig. 1.

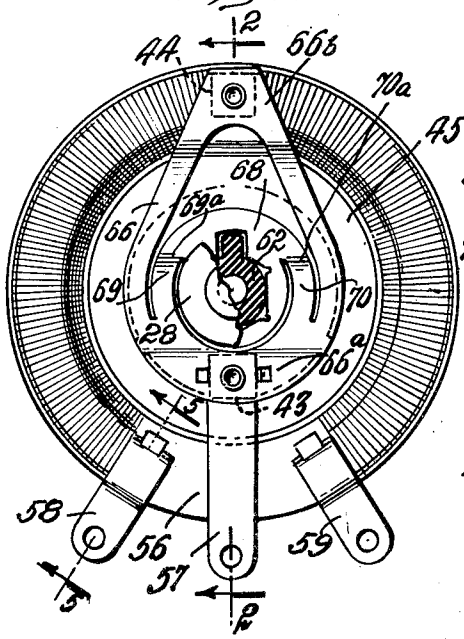


Fig. 2.

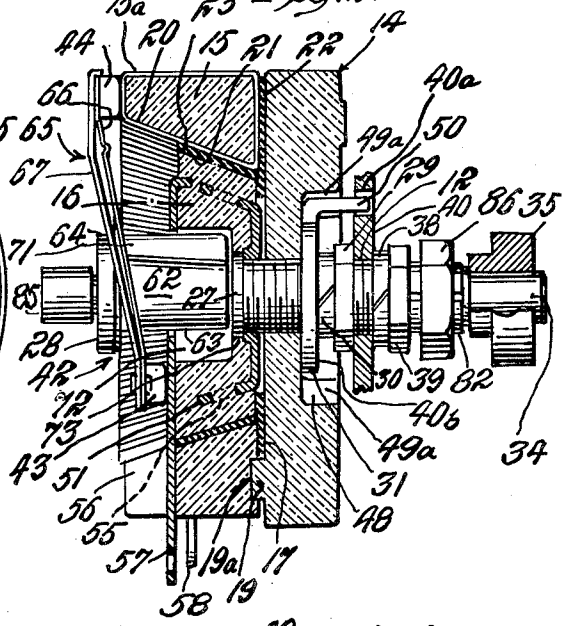


Fig. 3.

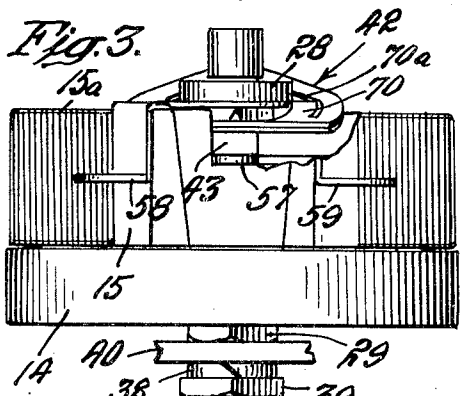


Fig. 4.

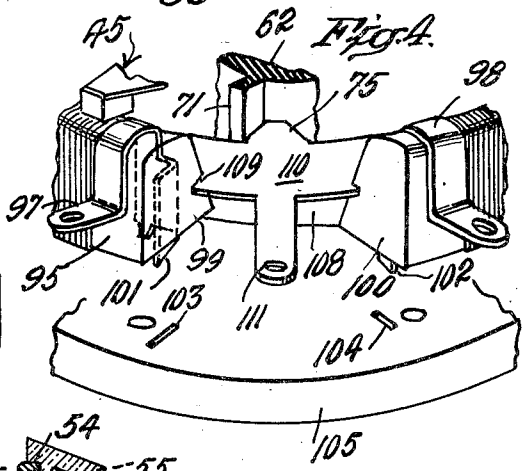


Fig. 5.

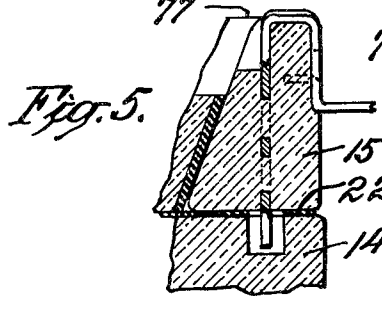
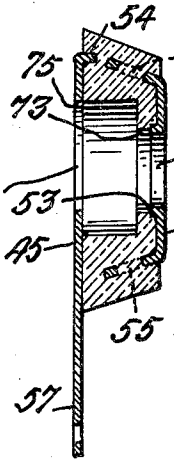


Fig. 6.



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RHEOSTAT

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Application April 9, 1954, Serial No. 422,096

14 Claims. (Cl. 201—48)

This invention relates to wire-wound rheostats and particularly to the insulating members supporting the resistance wire and contacts.

An object of this invention is to provide a wire-wound rheostat that will withstand shock of high intensity.

Another object of the invention is to provide a rheostat that has a high impact strength and a high power capacity.

Another object of the invention is to provide a rheostat of high impact strength that is small.

A further object of the invention is to provide a rheostat of high impact strength that is inexpensive to manufacture.

A still further object of the invention is to provide a rheostat of high impact strength that is interchangeable with standard rheostats of similar wattage.

A still further object is to provide a high impact rheostat that is composed of commercially standard materials.

Other and further objects and advantages will be apparent from the following description taken in connection with the drawings in which:

Fig. 1 is a top view of the rheostat;

Fig. 2 is a sectional view of the rheostat taken along lines 2—2 of Fig. 1;

Fig. 3 is a side view of the rheostat showing the terminals;

Fig. 4 shows a modification of the ring base;

Fig. 5 is a detailed sectional view of the terminals in the ring base taken along lines 5—5 of Fig. 1;

Fig. 6 is a view of the retaining means.

Electrical rheostats are mounted on instrument panels which, under extreme circumstances, may be subject to shattering forces. It is desirable, after such a force has been applied, that the equipment mounted on the panel is still in operable condition. This is particularly true in installations on naval vessels where instrument panels are subject to explosive forces.

In Fig. 2, the rheostat comprises an insulator base 14, an insulator mounting ring 15, and a clamping or retaining member 16 held together by the sleeve mounting means 12 and the nut 29. The ring member 15 and the clamping member 16 have complementary conical surfaces 20 and 21, respectively. The surface 21 of the holding member 16 presses against surface 20 of the ring member 15 to hold ring member 15 against surface 17 of the mounting base member 14, and positions the ring member 15. A cushion washer 22 of soft pliable material is preferably placed between the ring member 15 and the mounting member 14, and a conical shape cushion washer of pliable material is preferably placed between the clamping member 16 and the ring member 15. The washers 22 and 23 protect the surfaces of the insulated members from direct physical contact. The ring member 15 has a resistance wire 15*a* helically wound around the ring member 15 and forming an inner conical surface 20. The mounting member 14 and the holding member 16 have axial aligned holes through the center thereof to pass

the sleeve 12. A rotatable shaft 34 extends through the sleeve 12 with a contact assembly 42 mounted on the portion adajcent the retaining member and knob 35 or other rotating means mounted on the other end of the shaft.

The threaded sleeve 12 extends through the retaining member 16 and projects beyond the insulated base 14. At one end a hexagonal head or flange 27 engages the holding member 16 and on the other end a lock washer 30 and a reference washer 31 are tightened against the base 14 by the nut 29 to hold the inner retaining member 16 and insulating bases securely together. The surface 21 presses against surface 20 of the ring member to securely hold the ring member in position on the base 14. The rheostat may be mounted on a panel by inserting the sleeve 12 through a hole in the panel 40 and tightening the washer 38 and bolt 39 against the panel.

The insulating base 14 has a recess 48 with notches 49*a*, *b* to receive the reference washer 31 and a projection 50 on the washer. The indexing projection 50 fits into a slot 40*a* on the instrument panel 40 to position the rheostat in relation to the dials on the instrument panel. The base 14 is preferably made of an electrical insulative material having a high thermal conductivity, a high temperature resistance and high dimensional stability. Bosses 18 are positioned around the recess 48 and are spaced from the panel 40 so that the shock will be transmitted to the rheostat through the sleeve 12. The other side of the base 14 has a key 19 loosely fitting in a slot or recess 19*a* to key the base 14 and ring 15 in proper relationship and prevent the rotation of the ring in relation to the base. The surface 40*b* of the base is flat with the ring 15 setting firmly against the base 14 with a cushion washer 22 positioned therebetween. The sleeve 12 fits loosely in the opening through the base 14. The holding pressure is applied to the base by the ring 15 and the reference washer 31.

The retaining member has a recess 72 and an opening 73 aligned therewith to receive the contact assembly 42 and the sleeve 12. A supporting insert 51 molded in the retaining member 16 provides added shock resistance to the retaining member. The insert 51 is preferably cup-shaped with a central concentric hole or opening 52 formed by the inturned annular edge 53 and in alignment with the recess 72 and opening 73. The sleeve 12 extends through the opening 52 and the head 27 engages the edge 53 to provide a metallic shoulder against which the head 27 is pressed. The cup-shaped member has openings 55 to permit the flow of the plastic around the member to increase the strength of the retaining member. A collector ring 45 is molded on the outer surface with projections 54 embedded in the retaining member for securely fastening the collector ring and retaining member together. The ring 45 has an opening 74 concentric with the recess 72 and a stop 75 extending in the opening 74 to limit the rotation of the contact assembly 42. A terminal 57 extends from the collector ring 45 through a slot 56 and projects outside of the ring member. The collector ring extends circumferentially around the shaft 34 to provide a contact surface throughout the entire movement of the brush 43.

The member 15 is ring-shaped with a resistance wire or ribbon 15*a* helically wound around the surface thereof forming an inner conical surface 20 tapering radially outwardly in a direction from the base 14, a flat surface 76 bearing against the base 14 through washer 22, and a contact surface 77 on top of the member 15 engaged by the brush 44 of the contact assembly 65.

The cushion washer 23 between the surfaces 20, 21 is conically shaped and preferably of the open type. The thickness of the washer 23 depends on the spacing be-

tween the surfaces 20, 21 and the holding pressure applied to the ring member. The clamping pressure applied by the retaining member 16 is distributed between the pressure contact of the surfaces 20, 21 through the washer 23 and the pressure contact of the surfaces 24, 17 through the pad 22. This provides two parallel paths of pressure between the retaining member 16 and the base 14. One path is directly through the pad 22 and the other path is through the pad 23, ring member 15 and the pad 22. The thickness of the washer 23 determines the distribution of the pressure between the pads or washers, thus limiting the holding stress applied to the ring member.

The spacing between the surfaces 20, 21 changes with the size of the resistance wire on the ring member. A heavy wire reduces the spacing and a light wire increases the spacing. A plurality of washers may be nested to provide the necessary thickness to the washer 23 to transmit the pressure within the limits of compressibility of the washer.

The leg 112 has perforations 79 to assist in anchoring the terminal in the ring. The base or contact portion 80 of the terminal is exposed and raised above the contact surface. The resistance wire may be soldered or welded to the terminals at their respective ends of the wire. The terminals are spaced a small sector of the ring apart.

In between the terminals 58, 59 is a slot or channel 56 through which the terminal 57 of the collector ring 45 extends. The walls of the slot fit close to the terminal 57 preventing the relative rotation of the retaining or holding member 16 and the ring member 15. Thus the ring member 15 is locked from turning in relation to the base by the key 19 and slot 19*a* and the retaining member is locked from turning in relation to the base 14 by means of the terminal 57 and slot 56 and the ring member 15. The flange 27 is preferably angular in shape and sets in a recess in the retaining member 16 shaped to hold the sleeve 12 from rotating. Thus the sleeve is held from rotating in the rheostat.

It is therefore seen that the body of the rheostat is formed into three separate members clamped together by a threaded sleeve 12 and a nut 29. The rheostat is mounted on the panel by the sleeve 12 so that the impact of the shock is transmitted to the body members through the clamping sleeve. The division of the insulator body of the rheostat into parts reduces the intensity of the internal stresses in the rheostat and prevents stresses from developing at particular portions that will rupture the material.

The contact assembly 42 has an electrically insulating collar 62 with a tapered portion 63 and a flange 64. The collar is integrally molded on the shaft 34, Fig. 1. The brushes 43, 44 are mounted on the conducting resilient mounting means 65 at opposite ends of the arms 66, 67. The arm 67 preferably made of berryllium copper is a resilient supporting member on which the arm 66 and the brushes 43 and 44 are mounted. In Figs. 1 and 3 the arm 67 is shown fastened to the flat radial flange 68 by means of the intermediate members 69, 70. The members 69, 70 extend at angle to form the creases 69*a*, 70*a* with the flange 68. The intermediate members 69, 70 are resilient and resiliently connected to the arm 66 and the flange 68 along the creases 69*a*, 70*a* so that the mounting means 65 may be resiliently rocked or flexed in relation to the collar 62 and the insulating members of the rheostat. The flexibility equalizes the contact pressure of the brushes 43, 44 and cushions the shock applied to the insulating members through the contact assembly 42.

The arm 66, made of a soft copper, is in a plane at an angle to the shaft 34 to accommodate the difference in the level of the contact surface of the ring member 15 and the contact surface of the collector ring 45. The brushes 43, 44 are preferably mounted on the portions 66*a*, 66*b*, respectively, substantially parallel to the contact surfaces and are bolted thereto. The conductive arm 67, made of flexible copper sheet, is joined to the arm 66 at the portions 66*a*, 66*b* and conducts current between the brushes 43, 44. Current is conducted through the brushes and the high conductive arm 66. The arm is triangular in shape with a hole to accommodate the collar and made of thin sheet copper.

The collar may be made of a glass bonded mica to insulate the contact mounting means from the shaft 34. The resilient mounting means is pressed fitted on the collar 62 and has fingers 110 extending down from the flange 68 along the tapered surface of the collar to hold the mounting means on the collar and in alignment. The flange 68 holds the mounting means on the collar 62. On rotation of the shaft 34 the brushes 43, 44 slide over the contact surfaces from terminal to terminal. The arc of rotation is limited by the fin 71 on the collar 62 and the stop 75. The surface 63 of the collar 42 is tapered and the flange 68 of the resilient mounting means 65 is forced on the collar and positioned against the flange 64. The fin 71 on the collar extends longitudinally along the collar and projects from the tapered surface 63. The collar 62 and fin 71 extend into the recess 72 so that the fin 71 engages the stop 75 projecting from the collector ring 45 into the recess 72 (Fig. 4). The stop 75 and fin 71 limit the rotation of the brush 43 so that the brush does not slide past the terminals 58, 59. When the brush 43 reaches a terminal, the fin engages the stop and the brush contacts the terminal 58. In the other direction the rotation of the brush is similarly limited so that the brush does not slide past the terminal 59.

The brushes 43, 44 are preferably of the sintered powder type and the arm 67 is made of resilient copper to respond to the pressure applied between the collar 62 and the ring member 15. The arms 66, 67 are set at an angle and the collar 62 positioned on the shaft 34 in relation to the contact surface 77 to create a pressure between the brushes 43, 44 and the collector ring 45 and the ring member 15.

The shaft 34 is held in the sleeve 12 by the collar 62 and the snap ring 82. The snap ring fits in a groove in the shaft 34 and in conjunction with the collar 62 limits the axial movement of the shaft 34. On the other end of the shaft a coupling stud extends axially from the collar 62 for coupling a plurality of rheostat or other control devices in tandem. A cap 85 may be fitted over the stud when the rheostat is used singly.

The end of the sleeve 12 may have slits 85 to make the end flexible as shown in Figs. 1 and 3. A locking nut 86 having a tapering thread may be turned on the sleeve to force the split end against the shaft and lock the shaft in a desired position.

In Fig. 4 a modification of the rheostat is illustrated in which the ring member 95 terminates adjacent the terminals 97, 98 to form spaced ends 99, 100. The terminals 97, 98 have tongues 101, 102 projecting outside of the ring 95 through the mounting plate engaging surface and snugly fitting into slots 103 and 104 respectively to prevent rotation of the ring with respect to the base 105. The tongues 101, 102 and complementary slots 103, 104 are located adjacent the split in the ring member 95 resisting the tendency of the split ring to spread radially under the clamping pressure. The retaining member 108 clamps the ring member tightly against the base 105 to hold the rheostat together. The retaining member 108 may be keyed against relative rotation to the ring member and the base by an extension 109 of the collector ring 110 to fit in the space between the ends. The terminal 111 extends from the collector ring 110 between the spaced ends 99, 100. Cushions or pads of pliable material, similar to the pads 21, 22, are positioned between the conical surfaces of the retaining member 108 and the ring member 95 and between the base 105 and ring member 95.

The retaining member mounting base and ring mem-

ber are preferably made of an electrical insulating material having the properties of high temperature resistance, high thermal conductivity and dimensional stability. The retaining member may be utilized without the insert. However, the insert further improves the impact resistance by tending to bear the brunt of and minimize the stresses in the body of the retaining member.

It is thus seen that the insulator portion of the body of the rheostat is divided into three pieces. Any shocks or blows that impinge or strike against the instrument panel are transmitted through the mounting sleeve to the insulator body. The shock and vibration transmitted to the insulator body are absorbed by the individual members without their shattering or loosening the circulating members from one another. The clamping member, the ring member and the base member, under a heavy shock, may shift very slightly along the surfaces of contact if the internal forces become too great, thus avoiding the creation of a large internal force within the insulating body, and thus preventing shattering forces from developing within the insulating body.

Various modifications and changes may be made without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. A rheostat comprising a disc-shaped base having an opening through the center thereof, a ring-shaped member positioned on said base and having an inner surface tapering radially outward in a direction from said base to form a conical seating surface, a disc-shaped retaining member having a conical peripheral surface nesting inside of said ring member with the conical surfaces in engagement, said retaining member having a concentric hole through the center thereof and in alignment with the hole through the base, a threaded sleeve extending through said openings and having a flange at one end and a nut threaded on the bolt at the other end to draw the conical surface of said retaining member in tight engagement to hold said ring member on said base.

2. A rheostat as claimed in claim 1 wherein means are provided on said sleeve for mounting said rheostat on a panel.

3. A rheostat as claimed in claim 1 wherein said retaining member has a concentric shoulder engaged by the flange of said sleeve.

4. A rheostat as claimed in claim 1 wherein a resistance wire is helically wound around said ring member and has a concentric contact surface.

5. A rheostat as claimed in claim 4 wherein a rotatable shaft extends through said sleeve having a contact assembly mounted on one end of said shaft, said contact assembly having a brush engaging said contact surface.

6. A rheostat as claimed in claim 5 wherein said retaining member has a collector ring, and said contact assembly has a brush engaging said collector ring to receive voltage from said first brush.

7. A rheostat as claimed in claim 6 wherein said sleeve is split at one end and a tapered locking nut is provided to press said end to clamp said shaft in position.

8. A rheostat as claimed in claim 7 wherein an insulating sleeve having a tapered outer surface is provided for mounting said contact assembly and electrically isolating said shaft and said assembly.

9. A rheostat as claimed in claim 8 wherein said contact assembly comprises a resilient arm flexibly mounting said brushes on opposite ends thereof to equalize the contact pressures.

10. A rheostat as claimed in claim 1 wherein said ring member has two circumferentially spaced ends providing an opening in said ring member, and stops set in said ring member and in said base adjacent said ends for positioning said ring member and receiving the clamping pressures.

11. A rheostat as claimed in claim 1 wherein said base, said ring-shaped member and said retaining member have a high thermal conductivity, a high temperature resistance, a high dimensional stability and a high electrical insulation.

12. A rheostat as claimed in claim 1 wherein said retaining member has a metallic reinforcing insert with a shoulder concentric with said opening and engaging said flange to transmit the clamping pressures to said retaining member.

13. A rheostat comprising a mounting base, a member having a resistance wire mounted thereon, said member having a seating surface and a first clamping surface at an angle thereto, retaining means pressing against said mounting base and having a second clamping surface pressing said member on said mounting base, and resilient means between said clamping surfaces and said retaining member and said mounting base to distribute the pressure of said retaining means between said member and said mounting base.

14. A shock resistant rheostat comprising a mounting base having a peripheral seating area, a resistance member having a seating surface for engaging said seating area and having a clamping surface at an angle to said seating surface, retaining means having a second clamping surface and fastening means secured to said base for pressing said clamping surfaces together and said peripheral seating area against said seating surface to permit stress relieving movement between said base, said resistance member and said retaining means to prevent shattering of the rheostat on application of severe vibrations.

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